

## THE IMPACTS OF POSITIVE PSYCHOLOGICAL STATES ON PHYSICAL HEALTH: A REVIEW AND THEORETICAL FRAMEWORK

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**Abstract**—While much research has focused on the impacts of negative psychological states, such as stress, on physical health, relatively little research has examined the effects of *positive* psychological states. We suggest this imbalance is attributable to inadequate theoretical and methodological development regarding the impacts of positive psychological states on health. This paper presents a framework by which positive psychological states may influence physical health. Following this, we review evidence pertaining to this framework. We conclude by discussing methodological issues associated with this relatively new area of inquiry.

**Key words**—physical health, satisfaction, personal happiness, stress, positive emotions

### INTRODUCTION

*A merry heart doeth good like a medicine*  
[Proverbs 17:22]

A tremendous amount of research has examined the impacts of job stress on psychological and physiological disorder. This research has yielded invaluable evidence concerning the link between negative psychological states, such as stress, and mental and physical illness [1-7]. This research has provided invaluable information regarding the nature of the relationship between negative psychological states and health. However, by focusing solely on the impacts of *negative* psychological states, this research fails to answer an equally fundamental question: What are the impacts of *positive* psychological states on health?

While this question has been raised before [8-12], it has received little serious attention in the stress field. We believe this lack of attention is due to inadequate theoretical and methodological development regarding the impacts of positive psychological states on health. Without an appropriate theoretical and methodological basis to guide inquiry, systematic research in this area is not possible, and evidence concerning the impacts of positive psychological states on health will remain scattered and anecdotal.

The purpose of this paper is to establish a theoretical and methodological basis for research into the

impacts of positive psychological states on health. † First, we will present a theoretical framework to guide research in this area. Second, we will examine available evidence pertaining to the basic tenants of this framework. Finally, we will discuss methodological issues facing the researcher in this relatively new area of inquiry.

### POSITIVE PSYCHOLOGICAL STATES AND HEALTH. A THEORETICAL FRAMEWORK

In this section, we will present a theoretical framework concerning the impacts of positive psychological states on health. This framework will specify major pathways by which positive psychological states may influence health. This framework draws from a cybernetic theory of stress, coping, and well-being presented elsewhere [13-15]. Briefly, this model defines *stress* as a *negative discrepancy between an individual's perceived state and desired state, provided that the presence of this discrepancy is considered important by the individual* [cf. 16, 17]. By *perceived state*, we include the individual's cognitive representation of his or her physical and social environment. By *desired state*, we mean the state which the individual considers adequate [cf. 18]. By *negative discrepancy*, we mean that stress exists when the individual's perceived state *falls short* of his or her desired state. According to the model, stress will lead to two classes of outcomes. One class includes indices of psychological and physiological functioning which, taken together, represent the mental and physical health of the individual. The other class of outcomes consists of *coping*, which is defined as *efforts to prevent or reduce the negative impacts of stress on individual well-being*. These efforts are directed toward the determinants of stress, i.e. the perceived and desired states involved in the discrepancy and/or the amount of importance associated with the discrepancy. Thus,

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†Though our orientation is toward stress in organizations, we will present this discussion in general terms, thereby facilitating the application of this discussion to the effects of positive psychological states in both work and nonwork settings.

stress, coping, and well-being are viewed as critical components of a negative feedback loop, where stress damages well-being and produces coping, which in turn influences the determinants of stress [cf 19, 20]

The reader will note that, consistent with most theories of stress, this model focuses on *negative* discrepancies, or conditions where the individual's perceived state *falls short* of his or her desired state. This model may be readily adapted to include positive psychological states by explicitly acknowledging *positive* discrepancies, i.e. conditions where the individual's perceived state *exceeds* his or her desired state. Borrowing from Selye [21, 22], we will define a *positive discrepancy between an individual's perceived state and desired state, provided that the presence of this discrepancy is considered important by the individual*, as *eustress*. This definition is analogous with Selye's [21, 22] discussion of eustress, which refers to the pleasant, curative stress of fulfillment. This definition is also consistent with conceptualization of other positive psychological states, such as job satisfaction [18, 23], perceived quality of life [24] and subjective well-being [25].

There are two major processes by which eustress may influence health. One process involves the direct effect of eustress on health. That is, eustress may evoke physiological responses which, in the long run, improve physical health. This process may be viewed as the *converse* of stress and is therefore likely to influence health through many of the same underlying mechanisms. A second process involves the effect of eustress on coping. In other words, rather than affecting health directly, eustress may influence health indirectly by facilitating attempts to cope with existing stress, such that coping acts as a mediator of the relationship between eustress and health [11]. In the remainder of this section, we will elaborate these processes, in the following section, we will consider evidence regarding their validity.

#### *Direct effects of eustress on health*

Three aspects of the stress and coping process may produce eustress [15]. First, eustress may result from the direct appraisal of factors in the environment as meeting or exceeding desires. For example, a worker may view his or her income as more than adequate to meet his or her needs. This source of eustress is directly comparable to Locke's [18, 23] definition of job satisfaction, which refers to a positive psychological state resulting from the individual's appraisal of the work situation as meeting his or her values. Second, eustress may result from engaging in coping activities which are viewed as inherently enjoyable. For example, an executive may cope with qualitative overload by enrolling in an executive education program and find the program inherently enjoyable, *regardless* of its impact on experienced stress. Third, eustress may result from the successful accomplishment of coping activities *per se*. That is, holding constant the impacts of coping efforts on the focal stressor and the inherent properties of coping activities, the individual may derive pleasure from the sense of accomplishment associated with the successful implementation of coping activities. For example, a manager may cope with the stress of a poor fitness

examination by engaging in an exercise program which, though perhaps aversive, may produce a sense of accomplishment upon its completion. Thus, the stress and coping process may generate eustress through direct appraisal of the environment as exceeding desires, engaging in inherently enjoyable coping activities, or successfully executing coping strategies.

Given these three basic sources of eustress, what are the effects of eustress on health? One way to deduce these effects is to consider the health consequences of states where perceptions *meet* desires, i.e. where neither stress nor eustress are present. It is likely that this state is associated with gradual deterioration in physical health, due to the physiological entropy associated with the aging process. This notion is supported by studies indicating that, after controlling for social and psychological factors, age is still predictive of deterioration in health [26, 27]. Now consider the effects of stress on health. Extensive evidence suggests that stress promotes the development of long-term, degenerative diseases which ultimately cause premature death [1, 3, 5]. Given that stress promotes the development of degenerative diseases and that, in the absence of stress, these diseases continue to develop but at a slower rate, we might extrapolate to predict that eustress may *decrease* the rate of development of degenerative diseases and, if the extrapolation were valid, that high levels of eustress may actually *reverse* the development of disease, thereby improving health.

The notion that *any* psychological state, including eustress, may *improve* physical health is a radical departure from the current 'disease-oriented' view of the role of social-psychological factors in health. Such a departure requires an explanation of the physiological mechanisms by which psychological states may benefit health. In an insightful examination of this issue, Karasek *et al* [28] describe the pathways by which situations involving high demands combined with high control may produce physiological growth and regeneration. In general, these situations are consistent with our view of eustress. That is, high control implies the ability to meet the demands placed on the individual. If the individual desires to meet these demands and considers meeting them important, then eustress will result. Karasek *et al* [28] suggest that these situations stimulate the production of anabolic hormones, such as testosterone, insulin, adrenalin, and growth hormone. When the balance of these anabolic hormones exceeds catabolic hormones (e.g. cortisol), physiological growth may occur. For example, testosterone and growth hormone may actually enhance protein synthesis in the myocardium itself. Similarly, epinephrine response with quick return to baseline may selectively protect muscle tissue (including the myocardium), while mobilizing other body reserves for energy production. HDL cholesterol also plays a protective role by removing lipid deposits from the inner arterial walls [29]. Thus, eustress may directly influence health, and perhaps improve it, by stimulating the production of anabolic hormones, HDL cholesterol, and other health-enhancing biochemical substances. While this process is certainly speculative, it nonetheless suggests pathways by which eustress

may influence physiological mechanisms which ultimately improve physical health

#### *Indirect effects of eustress on health*

As indicated earlier, eustress may also influence health indirectly by facilitating attempts to cope with existing stress. In general, eustress may facilitate coping by enhancing individual abilities relevant for coping and/or stimulating increased effort directed toward coping. Note that these effects focus on the reduction of physiological damage associated with existing stress rather than the production of physiological benefit associated with eustress.

The effects of eustress on coping have been discussed by Lazarus *et al* [11] under the rubric of positive emotions. According to Lazarus *et al* [11], positive emotions occur when a transaction with the environment is appraised as desirable, a situation which is essentially identical to our conceptualization of eustress. Lazarus *et al* [11] identify three mechanisms by which eustress may facilitate coping. First, eustress may serve as a *breather* from ongoing stress. These breathers, or breaks, presumably facilitate coping by allowing periods for creative problem-solving (see also Ref [30]). Second, eustress may act as a *sustainer* of ongoing coping, increasing the likelihood that coping efforts will persist. Third, eustress may serve as a *restorer*, replenishing damaged or depleted resources or developing new resources. For example, positive experiences may bolster damaged self-esteem, which may in turn renew coping efforts. While breathers, sustainers, and restorers may indeed influence coping, Lazarus *et al* [11] fail to clarify several issues. First, if breathers operate merely by temporarily removing stressful experiences from awareness, then *any* alternate cognition, whether its emotional content is positive, negative, or neutral, would serve as a breather (obviously, a negative alternative cognition may cause additional stress, thereby nullifying its beneficial effect as a breather). It is therefore unduly restrictive to classify breathers as necessarily positive in emotional content. Second, Lazarus *et al* [11] describe challenge and hope as two examples of positive emotions which sustain coping. However, since both challenge and hope also involve a sense of optimism regarding future events, it is unclear whether positive affect or an optimistic outlook presumably facilitate coping [cf 31, 32]. Third, to function as a restorer, it seems that positive experiences must be relevant to the coping efforts in use. For example, it is doubtful that success in artistic endeavors would facilitate coping which requires analytical problem-solving. Thus, while the process by which breathers, sustainers, and restorers may influence coping certainly require further clarification and development, they nonetheless suggest three possible mechanisms by which eustress may facilitate coping.

Eustress may also facilitate coping through moderators identified in earlier stress and coping research [33]. For example, the positive affect associated with eustress may improve social interactions by decreasing social distance and winning social approval, which may in turn facilitate social support [34–36]. Eustress may also discourage the display of Type-A behavior. That is, the positive affect associated with

eustress is inconsistent with the negative affect associated with characteristic Type-A behaviors (e.g. aggressiveness, hostility, anger, irritability) and may therefore suppress their occurrence. In addition, eustress may facilitate feelings of mastery and control, which may in turn facilitate coping [37, 38]. In fact, the causal relationship between eustress and mastery may be bidirectional, such that eustress generates feelings of mastery, which in turn promote positive and perhaps humorous responses to stress [31, 39]. As these examples indicate, rather than playing an isolated role in coping, eustress may be an important component of stress-buffering factors, which have been the focus of previous research.

The mechanisms linking eustress and coping described above may be unified under a more parsimonious framework, by viewing coping as simply a task requiring both effort and ability [cf 40, 41]. The ultimate objective of this task is to alter the determinants of stress, i.e. the discrepancy between perceived and desired states and/or the amount of importance associated with this discrepancy [14, 42]. This view implies that, in order to facilitate coping, eustress must enhance either the amount of effort directed toward coping or the abilities required to alter the determinants of stress [14]. Eustress may enhance coping effort by promoting a sense of self-efficacy and optimism, particularly when the source of eustress is relevant to the coping task at hand [cf 11, 31, 32]. For example, a product manager who experiences eustress from a series of successful product innovations may cope with the stress of a new product from a competitor, by enthusiastically applying effort toward additional product innovations. Eustress may also enhance coping effort when it has been produced by coping in similar circumstances. That is, if coping in similar circumstances has been pleasurable, either inherently or based on its outcome, then this pleasure may act as an incentive to apply increased effort toward the coping task at hand. In addition to its effects on coping effort, eustress may also enhance coping abilities. For example, stress may hinder coping by interfering with the individual's ability to generate and evaluate coping alternatives [14]. It follows that periods of eustress may facilitate these abilities, thereby promoting effective coping. As indicated earlier, eustress may also enhance coping abilities by facilitating social interaction, which may in turn provide coping resources in the form of social support [34–36]. These examples illustrate only a few of the various mechanisms by which eustress may facilitate coping. While other mechanisms surely exist, we suggest that they share a common process, improving coping by enhancing either the effort directed toward coping or the abilities required to alter the determinants of stress.

#### *Summary*

In summary, eustress may improve health directly through hormonal and biochemical changes or indirectly by facilitating effort and abilities directed toward coping with existing stress. While these pathways are certainly speculative, they nonetheless outline potential processes by which eustress may improve health. In the following section, we will

attempt to examine the validity of these processes by reviewing evidence pertaining to the effects of eustress, as represented by various positive psychological states, on health

#### EUSTRESS, COPING, AND HEALTH A REVIEW OF THE EVIDENCE

Research concerning the effects of eustress, as defined here, on health is very scarce. However, by broadening our view of eustress to include positive psychological states in general, we can identify several areas of relevant research. These areas include anecdotal evidence, laboratory studies of positive affect and humor, positive life events, and job satisfaction. We conducted a computerized search of the organizational, psychological, and medical literatures to identify relevant studies in these areas. In this section, we will review and evaluate this evidence and note questions left unanswered by existing research.

##### *Eustress and health*

*Anecdotal evidence* Recently, Cousins [8, 9] recounted his recovery from *ankylosing spondylitis*, a paralyzing collagen illness. After a distressing and unsuccessful hospital stay, Cousins relocated himself to a hotel, stopped his medication, and commenced a program of megadoses of vitamin C and humorous movies and books, each of which appeared to independently improve his condition. After 4 weeks, Cousins was able to walk, and several months later he returned to nearly normal functioning. Moody [44] also presented anecdotal evidence from several sources. For example, he cited a case where clowns brought a catatonic girl out of her stupor. He also described Joseph Grimaldi, a nineteenth century comic, who apparently returned the hearing and speech of a deaf and dumb sailor during one of his performances. The sailor attributed the loss of his faculties to intense exposure to heat and sun during a recent trip. During Grimaldi's performance, the man struggled to express his great amusement over the antics on stage and apparently succeeded. Moody also cited a doctor of geriatric medicine who concluded that one attribute which all of his elderly patients had in common was a good sense of humor. Furthermore, Moody himself claims to have witnessed cases where patients are told they have only a few weeks or months to live but, due to a positive outlook and a will to live, survives for years. While the validity of these accounts is obviously limited, due to small sample size, the confounding of positive psychological states with other variables (e.g. vitamin C), and the absence of control groups, they nonetheless illustrate potential benefits of eustress on health.

*Laboratory experiments* The bulk of the experimental evidence regarding the impacts of positive psychological states on health involves the physiological concomitants of humor and laughter. According to cognitive humor theories [44, 45], humor involves the perception and subsequent resolution of some incongruity or ambiguity. If we assume that the incongruity or ambiguity is undesirable [46, 47], then this situation may be considered a source of stress. It follows that the humor associated with resolving

incongruity or ambiguity is analogous to the eustress associated with successful coping (i.e. resolving a discrepancy between perceptions and desires). Therefore, evidence regarding the physiological impacts of humor is relevant to our analysis of the consequences of eustress. This evidence is discussed below.

Experiments examining the physiological impacts of humor and laughter have primarily focused on indices of arousal, particularly heart rate, skin conductance, muscle tension, and respiratory patterns. This evidence has been aptly reviewed by McGhee [48] and Robinson [49], and a comprehensive review here would be unnecessarily redundant. However, a summary of these findings will facilitate our discussion. Evidence regarding the impacts of humor on arousal dates back to Spencer [50], who found altered respiratory patterns and increased heart rate and muscle tension associated with humor. Later, Martin [51] found increased heart and respiration in subjects who found cartoons amusing. More recently, Jones and Harris [52] presented 20 cartoons to nine undergraduates and measured rated humor and heart rate. Results indicated that humor ratings were associated with increased heart rate. Langevin and Day [53] presented 12 cartoons to 15 subjects, measuring heart rate, skin conductance, and rated funniness. Heart rate changes and maximum responses, and GSR amplitude and recovery time, were positively related to rated funniness. In a series of experiments examining the physiological concomitants of laughter, Fry [54-56] found that laughter reduced skeletal muscle tone, increased respiratory activity, oxygen exchange, muscular activity and heart rate, and stimulated the cardiovascular system, the sympathetic nervous system, catecholamine excretion, and endorphin production.

Several experiments attempted to assess changes in arousal during the course of a humorous experience. For example, Goldstein and his colleagues [57] gathered heart rate, skin conductance, and funniness data from 20 male undergraduates who were presented seven riddles and seven problems. Results indicated that heart rate increased during the question portion of both riddles and problems, and decreased slightly during answers. Chapman [58] divided subjects into groups who had given high or low funniness ratings to jokes. Independent of actual laughter, muscle tension was greater among the high funniness rating groups throughout the course of the joke. Godkewitsch [59] conducted two related experiments. In the first experiment, 24 female undergraduates read 24 jokes in which joke bodies and punch lines were separated. Measures included skin conductance, heart rate, self-reported arousal, and rated funniness. Results indicated that skin conductance rose during the joke body and that, at the punch line, heart rate, skin conductance responses, and self-reported arousal were positively related to rated funniness. The second experiment, using the same stimuli but measuring only self-reported arousal, found that self-reported arousal was positively related to funniness ratings gathered from the first experiment. Finally, Bushnell and Scheff [60] examined the physiological consequences of laughter over a longer time frame and found that, while laughter temporarily increased sympathetic nervous system activity,

it ultimately resulted in a net decrease in arousal and improvement in mood for up to 45 min

Several studies examined physiological responses to stimuli designed to produce multiple affective responses. Sternbach [61] examined autonomic responses (skin conductance, gastric motility, respiration rate, heart rate, eyeblink rate, finger pulse volume), among 10 children, to sad, frightening, pleasant, and humorous scenes in the movie *Bambi*. After the movie, subjects identified the scenes which were most sad, frightening, pleasant (happy), and funny. Results indicated a decrease in skin conductance and eyeblink during the saddest scene and a decrease in gastric motility during the happiest scene. In a later study, Levi [62] examined mood and urinary catecholamines responses among 20 female office clerks who viewed neutral, tragic, humorous, and frightening films. Levi found that the tragic and humorous films elicited moderate increases in adrenalin, while the frightening film elicited the greatest increase in adrenalin. In contrast, the humorous and frightening films elicited moderate increases in noradrenalin, while the tragic film did not elicit a significant increase in noradrenalin. Averill [63] examined affective and physiological responses (blood pressure, skin temperature, finger pulse volume, skin resistance, respiration) among 54 subjects viewing a sad, comedy, and control film. Results indicated that the sad film produced higher blood pressure, while the comedy films produced greater respiratory activity (due to laughter). Both the sad and comedy films produced greater electrodermal activity than the control film. Finally, Schwartz *et al* [64] examined blood pressure and heart rate changes among 32 subjects engaging in happiness, sadness, anger, fear, control, and relaxation imagery, both seated and during exercise. Happiness elicited higher systolic blood pressure and heart rate than relaxation and control, lower heart rate than anger and fear, and higher diastolic blood pressure than relaxation but lower diastolic blood pressure than anger.

Finally, two experiments conducted by Schachter and his colleagues suggest that, rather than resulting from emotion, arousal may interact with cognition to produce emotion. Schachter and Singer [65] injected 185 subjects with either epinephrine or a placebo. These subjects were then placed in situations designed to elicit either euphoria or anger. Results indicated that, compared to subjects who received the placebo, subjects who received epinephrine reacted with moderately greater euphoria in the euphoria condition and with moderately greater anger in the anger condition. Schachter and Wheeler [66] attributed the small size of these effects to the possibility that subjects who received the placebo may have nonetheless been aroused through their own sympathetic nervous system. To correct this, Schachter and Wheeler [66] injected 132 subjects with either an arousal-reducing, arousal-increasing, or placebo substance and measured laughter during a slapstick movie. Compared to subjects who received the placebo, subjects who received the arousal-inducing injection laughed more, while those who received the arousal-reducing injection laughed less. Note that these experiments do not rule out the notion that emotion produces arousal, but instead suggest that

the causal pathways between emotion and arousal may be bidirectional.

An experiment by Sales [67] focused on changes in serum cholesterol rather than sympathetic arousal. Sales presented anagrams at two levels of difficulty to 73 subjects for 12 5-min sessions. Measures included serum cholesterol, subjective workload, and task enjoyment. Results indicated that subjects in the high objective workload condition, who perceived low workload, exhibited an increase in cholesterol, while subjects in the low objective workload condition, who perceived high workload, exhibited a decrease in cholesterol. Sales surmised that these changes in cholesterol were associated with task enjoyment, such that subjects in the high objective workload condition, who perceived low workload, felt they were doing poorly on an easy task, while subjects in the low objective workload condition, who perceived high workload, felt they were doing well on a difficult task. This reasoning was supported by a significant negative relationship ( $r = -0.24$ ) between task enjoyment and change in cholesterol.

Finally, Edwards [68] specifically examined satisfaction and stress as competing predictors of physiological outcomes. Edwards presented anagrams of various levels of difficulty to 36 subjects for three trials. Blood pressure, heart rate, and self-reported stress and satisfaction were measured for each trial. Results indicated that satisfaction, as a positive mood state, was unrelated to stress, while stress and dissatisfaction were highly related. However, neither blood pressure nor heart rate were related to either anagram difficulty, satisfaction, or stress.

With few exceptions [61, 68], experimental evidence indicates that eustress, as represented by humor, laughter, and satisfaction, is associated with increased sympathetic arousal. However, several studies suggest that increased arousal is not unique to eustress, such that the intensity of the emotional experience, regardless of its affective tone, is associated with arousal [62, 64–66]. Furthermore, there is some evidence that increased arousal associated with eustress may be transient, such that eustress ultimately reduces arousal [60]. This notion is supported by Cousins [8, 9], who reported that a session of hearty laughter facilitated hours of uninterrupted sleep. Similarly, Freud [69] and Berlyne [70] have argued that humor and laughter serve a cathartic effect by releasing anxiety and tension and ultimately reducing arousal. In the single experiment measuring serum cholesterol [67], eustress apparently reduced cholesterol over a 1 hr interval. From this evidence, we may tentatively conclude that eustress is associated with temporary increases in arousal, but may ultimately produce physiological benefits in the form of decreased arousal and perhaps lower serum cholesterol.

*Positive life events* While a number of studies have explored the impacts of positive life events on mental health [71], we found only two published studies which examined the impacts of positive life events on physical health. Chiriboga [72] assessed the impact of positive, negative, and total life change on health and morale among 179 adults. Measures included a 48-item life events scale with each item rated for affective impact (happy vs unhappy) and degree of

preoccupation with the event and self-reported physical symptoms (energy, improvement in health, increase in health problems) Results indicated a significant negative relationship between positive events and health problems ( $r = -0.17$ ) In addition, negative events were negatively related to energy level and improvements in health In a later study, Svensson and Theorell [73] interviewed 19 hypertensive, 16 normotensive, and 12 hypotensive young men, with questions focusing on the occurrence and desirability of 48 life events during each subjects' life course No between-group differences were found for total life events or life events appraised as negative However, the hypotensive group reported progressively more positive events with increasing age than the other two groups Taken together, these studies provide tentative support for a modest negative relationship between positive life events and physical health symptoms

*Job and life satisfaction* As indicated earlier, our definition of eustress is consistent with existing conceptualizations of satisfaction [18, 23] Therefore, studies examining the relationship between satisfaction and health are directly relevant to our discussion Several studies have assessed the relationship between satisfaction and health using cross-sectional designs A number of these studies have relied on self-report measures of health For example, Hinkel and his colleagues [74] collected interview and questionnaire data from 100 Chinese graduate students to examine the relationship between psychological functioning and illness during the previous 20 years Students reporting a greater number of illness episodes viewed their lives as difficult, demanding, and unsatisfying, while those reporting fewer illness episodes viewed their lives as interesting, varied, and relatively satisfying More recently, Weintraub [75] examined the relationship between job satisfaction and risk of heart attack, musculoskeletal dysfunction, and psychosomatic dysfunction among 1279 employed adults Results indicated a negative relationship between job satisfaction and risk of heart attack for female workers, and between job satisfaction and psychosomatic dysfunction for both men and women Near *et al* [76] collected interview data from 1041 persons, focusing on occupation, occupational prestige, job tenure, housing, demographics, satisfaction, and perceived health Results indicated weak but significant correlations between health and job satisfaction ( $r = 0.09$ ), life satisfaction ( $r = 0.24$ ), and improvements in quality of life over time ( $r = 0.20$ ) Manning [77] examined the relationship between job satisfaction, physical health, and physical fitness among 122 participants in a human performance laboratory and found a negative relationship between intrinsic job satisfaction and both physical health and physical fitness Linn and associates [78] examined the relationship between life satisfaction and job satisfaction, stress, coping behaviors, health habits, and mental and physical health among 211 practicing internists, and found a negative relationship between life satisfaction and chronic symptoms and diseases ( $r = -0.18$ ) Meir and Melamed [79] measured job satisfaction, anxiety, somatic complaints, and vocational, avocational, and demands-abilities congruence among 74 female

primary school teachers Results indicated negative relationships between job satisfaction and both anxiety and somatic complaints Finally, Rahman and Sen [80] examined the relationship between job satisfaction and stress, performance, and health among 150 workers engaged in self-paced repetitive work and found a positive relationship between job satisfaction and health

Several cross-sectional studies have used objective rather than subjective measures of physical health For example, Schar *et al* [81] measured perceived stress, job satisfaction, family concerns, neuroticism, lung capacity, blood pressure, obesity, serum cholesterol, sugar and protein in urine, smoking, physical activity, flexibility, history of cardiovascular disease, and family history of cardiovascular disease among 885 Swiss factory workers Results indicated negative relationships between job satisfaction and perceived stress ( $r = -0.46$ ), serum cholesterol ( $r = -0.07$ ) and cardiovascular disease ( $r = -0.07$ ) More recently, McDonald and Gunderson [82] collected demographic, health, and job satisfaction data from 5831 naval enlisted men, using number of dispensary visits as an indicator of health Results indicated negative relationships between job satisfaction and number of dispensary visits ( $r = -0.12$ ) Hauenstein *et al* [83] interviewed 508 women, focusing on the impact of work load, importance of work, strain, and satisfaction on diastolic blood pressure A negative relationship was found between satisfaction and diastolic blood pressure, particularly among low SES women and working women who preferred the role of housewife Khaleque [84] examined the relationship between job satisfaction, perceived effort, and heart rate during working hours among 22 female factory workers Results indicated a negative relationship between job satisfaction and heart rate ( $r = -0.53$ ), but no relationship between perceived effort and either job satisfaction or heart rate Jenkins and his colleagues [27] conducted a more comprehensive study, collecting interview, questionnaire, and medical data from 204 male angina patients awaiting coronary by-pass surgery Results indicated a negative relationship between life satisfaction and resting angina ( $r = -0.26$ ) House and his colleagues [85] examined the relationship between stress, satisfaction, and various illness criteria (angina, ulcer, cholesterol, blood pressure) among 1809 white male factory workers Satisfaction was negatively related to ulcer, hypertension, and overall CHD risk, operationalized as scoring high on at least two of smoking, blood pressure, and cholesterol Finally, French *et al* [86] collected interview and physiological data (systolic and diastolic blood pressure, cholesterol, thyroid function, uric acid, cortisol) from 390 workers in eight occupational groups Interviews included questions regarding job satisfaction and person-environment fit on four dimensions (quantitative work load, job complexity, responsibility for persons, role ambiguity) These fit questions asked workers to indicate both current and preferred levels for each job dimension, thereby providing a direct operationalization of eustress as described in this paper Results indicated that positive discrepancies (i.e. situations where perceptions exceeded desires) for role ambiguity were negatively related to systolic and

diastolic blood pressure. However, given the large number of relationships tested (32), these results should be interpreted with caution.

Other studies of the relationship between satisfaction and health have employed longitudinal rather than cross-sectional designs. For instance, Palmore [87] examined the relationship between satisfaction and longevity by following 268 community volunteers for 15 years. Palmore found that, after controlling for age, the strongest predictor of longevity was work satisfaction ( $r = 0.29$ ), followed by happiness ( $r = 0.26$ ), physical functioning ( $r = 0.21$ ), and tobacco use ( $r = -0.21$ ). More recently, Vaillant [88] collected questionnaire and interview data from 188 men over a 40-year period, focusing on childhood environment, psychological adjustment (including job satisfaction), use of alcohol, cigarettes, and mood altering drugs, obesity, and physical health. Results indicated that both overall psychological adjustment and job satisfaction as an independent predictor were lower among men who were ill, disabled, or had died. Verbrugge [89] collected interview data from 589 men and women, assessing health status, health behaviors, stress, anxiety, social roles, and time constraints. Following this, daily health records were collected for 6 weeks, assessing general health status, symptoms, curative and preventive actions, mood, and special events. Results indicated that people who liked their work reported better health, fewer chronic conditions, fewer daily health problems, less conversation with friends about symptoms, and better daily moods. Satisfied people also tended to take more curative and preventive care for reasons unrelated to health status. Rosse and Hulin [90] interviewed 42 newly hired hospital employees over a 23-week period, measuring satisfaction, identification with the company, alienation, avoidance behaviors, attempts at change, somatic health, and mood. Results indicated a negative relationship between job satisfaction and health symptoms. Cassileth and associates [91] examined the relationship between job and life satisfaction and disease prognosis (relapse and survival rate) among 359 patients diagnosed as having unresectable cancers, melanoma, or breast cancer. No relationship was found between prognosis and either job or life satisfaction. Finally, House and his colleagues [26] examined the relationship between job characteristics, job tension, job satisfaction, intrinsic and extrinsic rewards, health behaviors, CHD, hypertension, bronchitis, and mortality among 2754 men and women. Analysis involved cross-sectional comparisons at time 1 and predictions of subsequent mortality. After controlling for age and health behaviors job satisfaction was unrelated to CHD, hypertension, bronchitis, or mortality.

Several investigators used the case-control method, comparing subjects with manifest disease to subjects without disease but with otherwise comparable risk. For example, Bruhn *et al* [92] compared 26 CHD patients who had died with 21 matched controls, using data from open-ended interviews and personality tests (e.g. MMPI). Analysis focused on differences between the groups in emotional drain, characterized by long-term, frustrating struggles with conflicts involving deep-seated values and beliefs. Results indicated that CHD patients exhibited more

emotional drain, particularly difficulties concerning work and marriage, while controls expressed greater satisfaction with their achievements and optimism toward the future. Wolf [93] compared 65 post-MI patients against matched controls on measures of aspirations, satisfactions, frustrations, personality, and cardiovascular functioning, and found that dejection and dissatisfaction were more frequent among the post-MI patients. Theorell and Rahe [94] used data from various psychological indices to compare 62 MI survivors with 109 men comparable in age and occupation. Post-MI men reported less work satisfaction but greater satisfaction with their financial state (possibly due to higher pay generated by their higher reported overtime work). Friedman and associates [95] administered a 155-item questionnaire to 330 patients who later developed MI and two groups of controls, one matched for demographics and one matched for both demographics and risk factors. Results indicated that items indicative of eustress (i.e. ability to laugh at jokes, feeling happy) were endorsed less frequently by MI patients than by controls. Kasl and Cobb [96] compared 56 male blue-collar workers whose jobs were terminated by plant closings to 46 steadily employed controls in terms of happiness, affective well-being, self-esteem, blood pressure, and heart rate. Results indicated that higher happiness, self-esteem, and affective well-being were associated with lower diastolic blood pressure. In a unique case-control study, Liljefors and Rahe [97] examined 32 pairs of twins who differed in CHD symptoms and occurrence (abnormal ECG during exercise, MI, angina pectoris). Interview data indicated that twins with greater CHD reported lower job and life satisfaction, including level of education, childhood experiences, adult personal relations, and working conditions.

Some studies did not collect satisfaction and physiological data from the same respondents but are nonetheless informative for our discussion. Hinkle [98] collected personality, life history, and self-report illness data from 68 Hungarian immigrants. Hinkle rated each year of each subject's adult life on a 5-point need-satisfaction scale. Results indicated that years rated as highly unsatisfactory were significantly associated with clusters of diseases of all causes. Sales and House [99] present three studies comparing job satisfaction scores drawn from various occupations with national standard CHD mortality rates associated with these occupations. The first study, using a single indicator of job satisfaction, found a negative relationship between job satisfaction and CHD risk for both white-collar ( $r = -0.63$ ) and blue-collar ( $r = -0.72$ ) occupations. The second study used a 7-item scale to measure intrinsic, extrinsic, and overall satisfaction and found negative relationships between CHD risk and intrinsic ( $r = -0.36$ ), extrinsic ( $r = -0.49$ ), and overall ( $r = -0.55$ ) satisfaction. The third study, using job satisfaction data from the JDI [100], again found negative relationships between CHD risk and intrinsic ( $r = -0.68$ ), extrinsic ( $r = -0.62$ ), and overall ( $r = -0.64$ ) satisfaction, but only for white-collar workers. All three studies were replicated, using other major causes of death as outcomes (tuberculosis, cancer, diabetes, hypertension with heart disease, influenza and pneumonia,



and accidents) None of these causes of death was significantly related to job satisfaction

With the exception of House *et al* [26], studies using either cardiovascular functioning or longevity as a criterion generally found a negative relationship between satisfaction and health, while studies using other health criteria typically found no such relationship [91, 99] These findings were, for the most part, consistent across studies using a variety of measures of satisfaction and employing cross-sectional, longitudinal, and case-control designs While one may be tempted to conclude that these results strongly support the beneficial effects of eustress on health, four words of caution are in order First, most measures of satisfaction tap both positive and negative affect, ranging from extreme dissatisfaction to extreme satisfaction As a result, an overall negative relationship between satisfaction and illness may actually reflect a *positive* relationship between dissatisfaction and illness A second and related issue involves the negative relationship between satisfaction and stress found in several studies [68, 78, 80, 81] Given the positive relationship between stress and illness prevalent in the literature, a negative correlation between satisfaction and illness may be spurious, in that stress may cause *both* lower satisfaction and increased illness Third, most investigators used the incidence of disease as a criteria rather than indices of physiological growth and regeneration, such as those discussed by Karasek *et al* [28] Therefore, a negative relationship between satisfaction and disease may simply reflect a reduction in disease rather than the production of some physiological benefit (this argument also holds for the relationship between positive life events and health) Fourth, studies using global assessments of satisfaction [74, 76] may confound satisfaction with perceived health, spuriously inflating the relationship between these variables In sum, while the evidence reviewed is consistent with the notion that eustress, as reflected in job and life satisfaction, benefits health, these findings are far from conclusive

*Optimism and hope* A handful of studies have examined optimism and hope as predictors of physical health Because both optimism and hope reflect expectations of a positive future, they may be regarded as anticipated eustress Hence, these studies are relevant to our discussion Udelman [101, 102] conducted two studies of the relationship between hope and immune system function among psychiatric outpatients Both studies indicated that hope, as measured by content analysis of speech samples, was associated with enhanced immune system function Scheier and Carver [103] examined the relationship between optimism (i.e. expectation of a positive future) and self-reports of physical symptoms Results indicated that optimism prospectively predicted lower symptoms

#### *Eustress and coping*

While a reasonable amount of research has examined the direct effects of eustress on physical health, very little research has focused on the effects of eustress on coping Available evidence falls into two categories, including anecdotal evidence and research

examining the stress-buffering effects of positive life events This evidence is reviewed below

*Anecdotal evidence* Two reports indicate that eustress, particularly humor, facilitated social interaction For example, Coser [34] found that humor on a hospital ward decreased social distance, socialized other patients into the society, provided an outlet for hostilities and discontent, and allayed anxiety Kaplan and Boyd [35] also studied humor on a hospital ward and found that humor created a feeling of intimacy and provided a means of winning social approval By facilitating social interaction, humor may also provide an opportunity to receive social support, which may in turn benefit individual attempts to cope with stress [cf 104]

*Positive life events* While a number of studies examined the stress-buffering effects of eustress on mental health [38, 105], we found only one study which examined its effects on physical health Cohen and Hoberman [106] administered measures of life events (rating the impact of each event on a negative to positive continuum), social support, and physical and depressive symptoms to 57 college students Results indicated that negative events were more strongly related to symptoms than total events, while positive events were unrelated to symptoms However, both positive events and social support buffered the impact of negative events on symptoms

#### *Summary*

The evidence reviewed above is consistent with the notion that eustress is associated with improvements in physical health This conclusion is supported by findings from a variety of sources, including anecdotal evidence, laboratory experiments, and studies of positive life events and job satisfaction While the bulk of the evidence pertains to the direct effect of eustress on health, scant evidence also suggests that eustress may benefit health indirectly by facilitating coping with existing stress However, due to the methodological issues noted above, this evidence is merely suggestive rather than conclusive, and with the exception of an experiment by Sales [67], not a single study demonstrated that eustress is associated with an *improvement* in physiological functioning rather than merely a reduction in physiological damage A conclusive demonstration of the effects of eustress on health requires attention to several methodological issues In the following section, we discuss methodological issues we feel are particularly important in assessing the relationship between eustress and health

#### METHODOLOGICAL ISSUES IN THE STUDY OF EUSTRESS AND HEALTH

As the preceding review indicates, evidence regarding the beneficial effects of eustress on physical health is suggestive but far from conclusive To generate more conclusive evidence, we must consider several methodological issues While many of these issues are relevant in traditional stress research, they are particularly important in eustress research In this section, we highlight what we feel are the prominent methodological issues in the study of eustress and health



### Measurement

The studies reviewed suggest two approaches to the measurement of eustress. One approach involves the assessment of perceptions and desires on commensurate (i.e. equivalent) dimensions [86], as well as the importance of these dimensions. A critical issue in this approach is the selection of relevant dimensions for assessing eustress. Two basic procedures may be identified. One procedure is to present the respondent with a preselected set of dimensions [40, 86]. This approach rests on the dubious assumption that we have correctly specified the dimensions which are relevant to each respondent. An alternative procedure is to solicit dimensions from each respondent individually [107]. This approach is likely to produce dimensions which vary across respondents but which are maximally relevant to each individual respondent. Variation in dimensions across subjects is not inherently problematic, because the proposed theory adopts a process approach [108], such that perceptions, desires, and importance, *regardless* of the specific dimension in question, constitute eustress. However, because the respondent is likely to provide only those dimensions that he or she views as important, the range of this variable will be restricted, making statistical tests involving *importance* difficult. Alternatively, one may use dimensions provided by both the researcher and the respondent, thereby capitalizing on the strengths of each approach.

A second, more general approach to the measurement of eustress involves the assessment of positive psychological states, such as happiness, satisfaction, and positive affect, an approach implicitly adopted in most of the studies reviewed. A major issue in this approach is establishing the presence of positive psychological states, rather than merely the absence of negative psychological states. This issue is critical because the presence of positive psychological states *cannot* be inferred from low scores on measures of negative psychological states. There are two primary reasons for this. First, measures of negative psychological states may suffer from a floor effect, such that they fail to discriminate varying levels of positive psychological states. This was found in the study by Edwards reviewed earlier [86], in which stress and dissatisfaction were highly related, whereas stress and satisfaction, as a positive psychological state, were unrelated. Closer examination revealed that variation in satisfaction was, in fact, compressed at the lower end of the stress scale. Second, research into self-reported mood suggests that measures of positive and negative affect are often uncorrelated [109, 110]. This suggests that, rather than representing opposite ends of a single continuum, positive and negative psychological states may represent two distinct constructs, which would require separate indices for their measurement.

Measuring variation in health associated with eustress also presents several challenges. For example, the effects described by Karasek *et al* [28] generally require invasive measurement procedures, such as drawing blood, which are costly and difficult to conduct. Furthermore, previous research suggests that different psychological states produce *patterns* of physiological response rather than simple, unified

outcomes [111]. For example, challenge without control may elevate both catecholamines and cortisol, while challenge combined with control may elevate catecholamines and *suppress* cortisol [112]. These findings suggest that a comprehensive assessment of physiological functioning may be required to detect the effects of eustress on health. Finally, a major challenge involves demonstrating *improvements* in physiological functioning. The assessment of such improvements requires more than the measurement of the presence or absence of disease. Rather, we must carefully assess a variety of indicators which are sensitive to both physiological benefit and damage, such as serum cholesterol and growth hormone [28], and track these indicators over time. By carefully assessing these indicators, we may be able to place physiological functioning on a continuum, ranging from illness and disease to growth and regeneration, thereby providing a means to test hypotheses regarding the beneficial effects of eustress on health.

### Design

While transient effects have been demonstrated [67], the long-term health consequences of chronic eustress have yet to be determined [cf 113, 114]. To clearly demonstrate these long-term effects, we must adopt longitudinal designs which repeatedly assess eustress and health from a cohort of respondents. Retrospective designs common in both stress and eustress research are plagued with a host of problems, such as inaccurate recall, inability to assess changes in health over time, and potential confounding of stress and eustress with health [115]. Ideally, of course, we would randomly assign respondents to conditions designed to generate various levels of eustress and measure changes in an array of physiological indicators [cf 105]. However, manipulating eustress is potentially unethical and impractical, and causality often must be inferred from quasi-experimental designs [115].

### Analysis

Several issues associated with data analysis deserve mention. First, if the researcher assesses eustress as a discrepancy between perceived and desired states, he or she may be tempted to create a single index of eustress by using the difference between perceptions and desires across multiple dimensions. This procedure, and the use of difference scores in general, have been criticized on both theoretical and methodological grounds [116–118], and these criticisms need not be repeated here. As an alternative, we recommend using separate indicators perceptions and desires in analysis, and testing the joint effect of these variables as predictors of physiological functioning [116, 118]. Second, the above recommendation regarding multiple indicators of physiological functioning requires multivariate analytical techniques. Of the studies reviewed, those which employed multiple criteria either combined them to form a summary index or analyzed each criterion separately in piecemeal fashion. Both procedures are inappropriate, in that the former results in a loss of information, the latter increases the risk of type I error, and both fail to account for interrelationships among the criteria variables. These problems may be avoided by the use

of currently available multivariate techniques, such as multivariate regression [119] and structural equations modeling [120, 121]

A third issue involves controlling for risk factors known to affect health, such as smoking, diet, medical care, and alcohol consumption. While this procedure is common and generally recommended [88], it should be emphasized that it isolates the *independent* contribution of psychological states to physical health. By doing this, we overlook the possibility that psychological states may influence health behaviors related to risk factors, which may in turn influence physical health. Furthermore, this technique estimates the effects of eustress as if individuals did not differ on risk factors, thereby creating an artificial situation [115]. Again, multivariate procedures, particularly structural equations modeling, would help uncover the causal pathways by which standard risk factors and psychological variables combine to influence physical health.

#### SUMMARY AND CONCLUSION

Compared to the impacts of negative psychological states, the impacts of positive psychological states on physical health have received relatively little research interest. In this article, we have presented a framework for examining the effects of positive psychological states on health and reviewed evidence regarding these effects. This framework extends existing theoretical work on stress, coping, and well-being [13–15] by incorporating eustress, defined as a positive discrepancy between perceptions and desires, provided that the presence of this discrepancy is considered important by the individual. Eustress may improve health directly through mediating physiological process or indirectly by facilitating coping with existing stress. Evidence regarding the positive impacts of eustress on health is generally supportive, but various methodological problems prevent firm conclusions. To gain further insight into the potential benefits of eustress on health, we recommend longitudinal research incorporating comprehensive assessment of psychological states and physiological functioning. Hopefully, future research will address the effects of both stress and eustress on health, ultimately including criteria of both physical and mental functioning.

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